AMBIENT AIR MONITORING FOR PESTICIDES IN LOMPOC, CALIFORNIA

VOLUME 1: EXECUTIVE SUMMARY

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Introduction

Lompoc is a small agricultural city located in a coastal valley of Santa Barbara County, California (Figure 1). Five major crops or crop groups are grown in the area between Lompoc and the coast: cole crops (broccoli, cabbage, and cauliflower), lettuce, dried beans, celery, and flowers. As with most coastal valleys, the area is cool with frequent fog or low cloudiness, and winds are predominantly from the northwest or west; Lompoc is downwind from the agricultural area.

Lompoc Interagency Work Group*: The LIWG is composed of staff from federal, state, county, and city agencies, as well as community representatives who assist DPR in its investigation of pesticide use and community health. The Health Subgroup addresses health issues. The Technical Advisory Group addresses pesticide issues. The Other Environmental Issues Subgroup addresses crystalline silica, radon, and other potential contaminants. Members of the group are listed in the main report.*

In 1997, the Department of Pesticide Regulation (DPR) formed the Lompoc Interagency Work Group (LIWG) to help investigate Lompoc residents' concerns about pesticide use as it relates to community health. An earlier analysis of hospital discharge data suggested that certain respiratory illnesses occurred in Lompoc at rates higher than in comparison areas. Subsequently, the LIWG directed its Technical Advisory Group to examine three questions: 1) are residents of Lompoc exposed to pesticides, 2) if so, which pesticides and in what amounts, and 3) do measured levels exceed levels of concern to human health. DPR conducted air monitoring in Lompoc to answer these questions. In 1998, Phase One monitoring tested the sampling and analytical methodology (described in main report). This report describes the comprehensive monitoring in 2000.

Pesticides and Area Monitored

Fumigants*: Fumigants differ from most other pesticides in several ways. They are gases and at least 1000 times more volatile than other pesticides. They are applied infrequently, but at rates at least 10 times higher than other pesticides. For these reasons, fumigant air concentrations can be much higher than other pesticides.*

In 2000, DPR monitored ambient air for 31 pesticides and breakdown products, choosing potentially higher risk pesticides based on their toxicity, volatility, and amount of use. Three fumigant pesticides were monitored individually in one part of the study. The remaining 28 pesticides and breakdown products – consisting of a variety of insecticides, herbicides, and fungicides – were monitored simultaneously in the second part of the study (descriptions of all pesticides are given in the Results and Discussion section). Monitoring was conducted at five locations in the northwest, west, southwest, central, and northeast portions of Lompoc for the fumigants and four of these locations (northeast excluded) for the remaining pesticides (Figure 1).

Methods

Monitoring Plan – DPR employed two different monitoring plans, one for the three fumigants and one for the remaining 28 pesticides and breakdown products. Fumigants are applied infrequently, so the monitoring plan targeted selected applications, specifically large applications in close proximity to Lompoc. DPR monitored six metam sodium (or potassium) applications for methyl isothiocyanate (MITC), and two methyl bromide-chloropicrin applications during 2000. For each of the applications, DPR monitored for a 72-hour period beginning with the start of fumigation. The 72-hour monitoring period consisted of six alternating 8-hour (day) and 16-hour (night) sequential samples. The California Department of Health Services performed the primary laboratory analysis of the MITC samples. The California Department of Food and Agriculture performed the primary laboratory analysis of the methyl bromide and chloropicrin samples.

***Breakdown Products**: Over time, pesticides degrade to other chemicals, or breakdown products. **Oxygen analogs** are breakdown products of **organophosphate** insecticides. Unlike most breakdown products, the oxygen analogs are usually more toxic than the parent organophosphate.*

For the remaining pesticides, DPR monitored 22 pesticides and five oxygen analog (OA) breakdown products simultaneously during the peak use period for most of the pesticides, between May 31 and August 3, 2000. During this 10-week period, DPR collected 24-hour samples, four consecutive days per week at each of the four monitoring locations. DPR collected additional samples for a single pesticide, oxydemeton-methyl for a two-week period. The University of California, Davis performed the primary laboratory analysis, using a new method developed specifically to analyze the pesticides used in Lompoc.

***Method Detection Limit**: The method detection limit is the smallest amount of the chemical that can be identified in a sample with the method employed. If the sample contains no chemical, or may have a concentration less than the detection limit, the sample is designated as having **no detectable amount (nd)**. When calculating average concentrations, DPR assumes that samples with no detectable amount have a concentration of one-half the detection limit.*

***Estimated Quantitation Limit**: The estimated quantitation limit is the smallest amount of the chemical that can be measured. Samples with concentrations less than the quantitation limit, but more than detection limit are designated as containing a **trace** amount, but the concentration cannot be measured reliably.*

Quality Control Methods – The monitoring included extensive quality control measures to validate the methods prior to the study and check the methods' performance during the study. The method validation verified that the lowest possible detection limits and quantitation limits were achieved and ensured that the detection limits were lower than the health screening levels. The quality control measures included analysis of samples containing known amounts of pesticides (spikes) to determine accuracy, samples containing no pesticides (blanks) to detect inadvertent contamination, duplicate samples to determine precision, and samples analyzed by a second laboratory for confirmation. A multi-agency group, led by the Air Resources Board, conducted several audits to ensure appropriate procedures were followed.

Methods for Collecting Weather and Pesticide Use Data – DPR collected weather and pesticide use information to help evaluate the monitoring data. DPR established a weather station west of Lompoc (Figure 1) to measure wind speed, wind direction, temperature, and humidity during the monitoring. DPR maintains a database of all agricultural pesticide applications in California, including date applied, amount applied, and application location.

When calculating average concentrations, DPR assumes that samples with a trace amount have a concentration of the midpoint between the detection limit and the quantitation limit.

Screening Level*: State or federal health standards have not been established for most pesticides in air. DPR uses screening levels to evaluate the possible health effects of exposure to a chemical, based on a chemical's toxicity. A concentration that is below the screening level is not considered to represent a significant health concern and would not generally undergo further evaluation, but also should not automatically be considered "safe." By the same token, a concentration that is above the screening level does not necessarily indicate a significant health concern, but indicates the need for a further and more refined evaluation. Different screening levels are determined for different time periods of exposure.*

Exposure Periods*: The toxicity of a pesticide and its screening level depend on the duration of exposure.* ***Acute*** *or short-term exposure is generally one day or less.* ***Subchronic*** *is generally up to a significant portion of a year.* ***Chronic*** *or long-term exposure is generally one year or more.*

Pesticide Interaction*: Pesticides may interact in several ways.* ***Additive*** *interaction occurs when one chemical adds to the toxicity of another chemical.* ***Synergistic*** *interaction occurs when one chemical multiplies the toxicity of another.* ***Antagonistic*** *interaction*

Health Evaluation Methods – DPR, with the assistance of the Department of Health Services (DHS) and the Office of Environmental Health Hazard Assessment (OEHHA), evaluated the monitoring data for potential health risks from exposure to individual pesticides as well as multiple pesticides (cumulative risk). The health risks were evaluated using screening levels established from toxicological data using scientifically accepted health protective assumptions. These included the application of factors to address areas of uncertainty, such as extrapolating from animal data to humans and the possibly increased sensitivity of children. Different exposure time periods had different screening levels. Acute (short-term) screening levels were determined for exposures of one day. Subchronic (intermediate-term) screening levels were established for exposures from 3 to 14 days duration. Chronic (long-term) screening levels were established for exposures of 10 weeks or greater.

The risk from multiple pesticides was evaluated by calculating the hazard quotient and hazard index. First, the risk for each individual pesticide was calculated as a hazard quotient according to the following equation:

$$\frac{\text{Air Concentration Detected}}{\text{Screening Level}} = \text{Hazard Quotient}$$

A hazard quotient is the air concentration detected expressed as the percentage of the screening level. For example, if the air concentration is 25 percent of the screening level, then the hazard quotient is 0.25. When the hazard quotient is greater than one the air concentration exceeds the screening level and further analysis of the data is required. The risk from multiple pesticides was calculated as a hazard index, by adding all of the hazard quotients for the individual pesticides:

$$\begin{aligned}\text{Hazard Index} = &\ \text{Hazard Quotient of Pesticide 1}\\ &+ \text{Hazard Quotient of Pesticide 2} \ldots\\ &+ \text{Hazard Quotient of Pesticide 31}\end{aligned}$$

Pesticides may exhibit toxic effects independently, or they may interact in an additive, synergistic, or antagonistic manner. The hazard index assumes that toxicity and risk of the monitored pesticides are additive. The monitoring included organophosphate insecticides and oxygen analog breakdown products that are toxic to the nervous system, and are known to act in an additive manner. As with the hazard quotient, a hazard index greater than one indicates further analysis is required. DPR, DHS, and the OEHHA *occurs when one chemical diminishes the toxicity of another.*

consider hazard quotients and hazard indices less than one as indicative of low risk.

Results and Discussion

***Concentration and Units**: The concentration is the amount of a chemical in an amount of air. Concentrations in air can be expressed in units of volume or weight. For this study, concentrations are expressed as **nanograms per cubic meter (ng/m^3)**. This unit refers to the weight in nanograms of a pesticide contained in one cubic meter of air. A nanogram is one-billionth of a gram.*

Of the 31 pesticides or breakdown products monitored in the two study parts combined, DPR detected 27 of them in one or more of the 451 samples collected and analyzed (Table 1). While many pesticides were detected, and some quite frequently, air concentrations were low compared to health screening levels. None of the air concentrations exceeded the screening levels for any of the exposure periods (acute, subchronic, chronic; Tables 1, 2, and 3). The fumigant MITC had the highest concentration (1885 ng/m^3) and risk (hazard quotient 0.29 for subchronic exposure) for an individual pesticide. Chlorthal-dimethyl was detected most frequently, in 91 percent of the samples.

NOTE: The hazard quotient for MITC chronic exposure was 0.81. However, this study was not designed to determine chronic exposure for MITC, and this estimate may not be reliable.

The hazard indices (cumulative risk) for the 28 pesticides monitored simultaneously did not exceed one, indicating a low health risk (Figure 2). The hazard indices also did not exceed one by adding the exposure for the fumigant pesticides not included in the simultaneous monitoring (particularly MITC). Chlorpyrifos and its oxygen analog, MITC, diazinon and its oxygen analog, PCNB, cycloate, and naled accounted for most of the risk (Figure 3).

Twelve of the monitored pesticides may cause cancer in humans. Due to their mechanisms of action, the cancer risk of five of these pesticides (dicofol, dimethoate, metolachlor, PCNB, and vinclozolin) was included in the derivation of the chronic screening levels. For these pesticides, the cancer effects were assessed as part of the chronic evaluations, both for the individual and multiple pesticide exposures. The carcinogenic effects of the other seven pesticides (chlorothalonil, chlorthal-dimethyl, ethalfluralin, iprodione, permethrin, propyzamide, and trifluralin) are due to a different mechanism of action. As a result, their cancer risk is evaluated separately from the other chronic effects. For these seven pesticides, the estimated combined cancer risk or probability for the occurrence of cancer from exposure to these pesticides is estimated to be 4.8 in 100,000,000, more than 20 times less than the normal benchmark of negligible risk of one in 1,000,000.

<u>Pesticides Monitored</u>

Chloropicrin
fumigant, usually mixed with methyl bromide; used for agriculture and structural use.

***Chlorothalonil** (Bravo, Daconil) chloronitrile fungicide; used for agriculture and residential.*

***Chlorpyrifos** (Dursban, Lorsban) organophosphate insecticide, oxygen analog analyzed; used for agriculture and residential.*

***Chlorthal-dimethyl** (Dacthal, DCPA); benzoic acid herbicide; used for agriculture and residential.*

***Cycloate** (Ro-Neet); thiocarbamate herbicide; used for agriculture.*

Diazinon
organophosphate insecticide, oxygen analog analyzed; used for agriculture and residential.

***Dicloran** (Botran, DCNA) dinitroaniline fungicide; used for agriculture.*

Dicofol *(Kelthane)*
organochlorine insecticide; used for agriculture and residential.

Dimethoate *(Cygon)*
organophosphate insecticide, analyzed oxygen analog; used for agriculture.

EPTC *(Eptam)*
thiocarbamate herbicide; used for agriculture and residential.

Ethalfluralin *(Sonalan)*
dinitroaniline herbicide; used for agriculture.

Fonofos *(Dyfonate)*
organophosphate insecticide, analyzed oxygen analog; not currently manufactured; old stocks may still be used; used for agriculture.

Iprodione *(Rovral)*
dicarboximide fungicide; used for agriculture and residential.

Malathion
organophosphate insecticide, analyzed oxygen analog; used for agriculture and residential.

Mefenoxam *(Apron, Dividend, Maxim, Subdue); phenylamide fungicide; used for agriculture and residential.*

Methyl Bromide *(Bromogas, MBR, Metabrom, Tri-Con); fumigant, always mixed with chloropicrin; used for agriculture and structural.*

Methyl Isothiocyanate, MITC *(metam-sodium, metam-potassium, Vapam, K-Pam); fumigant; breakdown product of other pesticides such as metam-sodium; used in agriculture.*

Metolachlor *(Dual)*
chloroacetanilide herbicide; used for agriculture and residential.

Weather conditions during most of the monitoring were typical of the Lompoc area, with the wind from the west-northwest (Figure 4). The wind direction coincides with the west and northwest monitoring locations having the highest air concentrations and risk (Table 4). Most methyl bromide/chloropicrin fumigations, including the fumigation monitored, were located east and downwind of Lompoc, accounting for the low or no detectable air concentrations for those pesticides.

Overall, pounds of pesticides used in Lompoc have increased over the last several years, with the fumigants accounting for the increase (Figure 5). Use of most other pesticides has decreased over the last several years. Of the 26 pesticides monitored, six (diazinon, dicofol, ethalfluralin, fonofos, simazine, and trifluralin) were not reported applied during the monitoring period. However, five of these pesticides were detected at trace levels (all but simazine). The detections may be due to unreported use or use not required to be reported (home, industrial, institutional, etc.). As in previous years, peak use in 2000 for most of the monitored pesticides occurred in May through August (Figure 6). Most pesticide use occurred in the agricultural area west of Lompoc (Figure 4).

It was not possible to estimate air concentrations of pesticides using computer modeling and statistical techniques for time periods and locations that were not monitored. This is due to the lack of information for some factors that influence air concentrations of pesticides, such as the rate of volatilization. However, comparing pesticide use patterns during the monitoring period to those in the non-monitored months may provide a qualitative estimate of the air concentrations during the non-monitored months. Generally, the greater the amount of pesticides applied each day, the greater the daily air concentration of pesticides and thus, acute exposure. For example, the highest amount of metam sodium or metam potassium applied in one day during the monitoring perid was 5,104 pounds. In contrast, the highest amount of metam use reported for any day between 1996 and 2000 was 18,626 pounds. This would indicate that exposure on some of the non-monitored days may have been higher. For the remaining monitored pesticides combined, the highest amount of multiple pesticides applied on any individual day during the monitoring period was 294 pounds. Similarly, the highest amount of multiple pesticides applied on any day for all of 2000 was 361 pounds. For the individual pesticides, chlorothalonil, cycloate, iprodione, MITC, permethrin, and vinclozolin, some non-monitored days during 2000 had two to four times more use than monitored days, which may indicate a higher air concentration and thus higher exposure to these six pesticides on those particular days.

Naled *(Dibrom)*
organophosphate insecticide, does not degrade to oxygen analog; used for agriculture and residential.

Oxydemeton-methyl *(Metasystox-R); organophosphate insecticide, analyzed as parent and oxygen analog combined; used for agriculture and residential.*

PCNB *(Terrachlor)*
organochlorine fungicide; used for agriculture and residential.

Permethrin *(Ambush, Pounce)*
pyrethroid insecticide; used for agriculture and residential.

Propyzamide *(Pronamide, Kerb)*
amide herbicide; used for agriculture and residential.

Simazine *(Princep)*
triazine herbicide; used for agriculture and residential.

Trifluralin *(Treflan)*
dinitroaniline herbicide; used for agriculture and residential.

Vinclozolin *(Curalan, Ronilan, Vorlan); dicarboximide fungicide; used for agriculture and residential.*

Excluding fumigants, the amount of pesticides applied each month gives an indication of monthly air concentrations, and subchronic and chronic exposure. Most of the monitoring occurred during June and July. These months include at least one of the three highest use months for 15 of the 23 monitored pesticides. Cycloate had a monthly use 2.3 times higher in November than June/July, the highest relative monthly use for the monitored pesticides. Cycloate air concentrations may be higher for some months not monitored. Monthly pesticide use is an inappropriate indicator for fumigants because monitoring occurred over three-day periods.

Most of the quality control data was within the normal range. None of the blank samples contained detectable concentrations, indicating inadvertent contamination did not occur. The analysis of spiked samples recovered more than 70 and less than 120 percent for most pesticides, a common acceptable range. Chlorpyrifos oxygen analog, cycloate, EPTC, ethalfluralin, and MITC had low recovery of some spiked samples, between 70 and 37 percent. Air concentrations for these pesticides may be underestimated. Data for MITC are adjusted to compensate for the low recovery. Concentrations are so low for the other pesticides that an adjustment has a negligible effect since the highest hazard quotient for any of these four pesticides is 0.02.

Eleven of the pesticides and two breakdown products monitored in Lompoc have been monitored in other areas of the state. For nine pesticides and two breakdown products, concentrations in other areas were higher than Lompoc. The other two had trace or no detectable concentrations in Lompoc and other areas (Table 5). These results are consistent with higher pesticide use in other areas of the state.

Conclusions and Recommendations

The monitoring was designed to answer three questions:

1) **Are residents of Lompoc exposed to pesticides? Yes, 27 pesticides were detected in one or more samples.**
2) **If so, which pesticides and in what amounts? MITC had the highest measured concentration, 1885 ng/m^3.**
3) **Do measured levels exceed levels of concern to human health? No, the concentrations of the individual and the combined pesticides did not exceed health screening levels. However, concentrations of some pesticides may be higher during some days or months not monitored.**

The air concentration of individual pesticides did not exceed their screening levels, indicating a low risk from the monitored pesticides. Moreover, the health risk from inhalation of all monitored pesticides combined was also low, as measured by the hazard indices, and the cancer risk of the monitored pesticides was negligible.

While the risk was low, in relative terms five pesticides accounted for more than 90 percent of the risk: MITC, chlorpyrifos (and its oxygen analog breakdown product), diazinon (and its oxygen analog breakdown product), cycloate, and PCNB.

The risk from methyl bromide and chloropicrin fumigations is difficult to estimate because these applications occur east of Lompoc, and downwind of the city during normal weather conditions. With the available data, it will be problematic to estimate the fumigant air concentrations and the probability that the wind direction will be opposite of normal.

The weather and pesticide use at the time of the monitoring are consistent with historical patterns in the Lompoc area. The predominant wind direction was from the northwest – west and the majority of the pesticides were applied in the agricultural area to the west (upwind) of the city. Since most of the monitoring sites are near the western edge of the city and the closest to the majority of pesticide applications, few if any locations within Lompoc should have higher air concentrations than documented here.

Some individual pesticides may have air concentrations higher than reported here because of the amount (pounds) applied on days or months that were not monitored was higher than on the days or months that were monitored. The air concentrations for chlorothalonil, cycloate, dicloran, iprodione, MITC, PCNB, permethrin, and vinclozolin may be higher than documented here since some days or months not monitored had two to four times more use. However, since the highest air concentration for these pesticides was four percent of the screening level, it's unlikely that the air concentrations for these or any of the other pesticides exceeded the screening levels on any day or month in 2000.

This study likely documents the upper end of the cumulative or combined risk of all monitored pesticides for 2000. Other days, weeks, or months (acute, subchronic, and chronic exposure) in 2000 should have comparable or lower cumulative risk than documented here because the combined use for all monitored pesticides was comparable or lower for other days and months in 2000.

This study was designed to monitor higher-risk pesticides, in higher-risk areas, during higher-risk periods. The monitoring data as well as the pesticide use data for periods not monitored all indicate that the inhalation risk from pesticides monitored in the Lompoc area is low. However, **as with all scientific studies, these risk estimates have uncertainties**. Key uncertainties in the toxicological data include the lack of information for some potential toxic effects such as hormone or immune response disruption. Several of the pesticides may also interact in an unexpected manner. The key uncertainty in the monitoring data is the lack of information for pesticides not monitored. In addition, the risk from other routes of exposure such as ingestion or absorption through the skin is outside the scope of this study. More stagnant meteorological conditions may occur during the winter and may lead to comparable air concentrations with lower pesticide use. These uncertainties cannot be quantified. Therefore, the effect of these uncertainties on the risk estimates cannot be determined.

Only MITC had measured air concentrations that approach its screening levels. DPR manages pesticides statewide based on the areas or populations at greatest risk. Monitoring and control of pesticides in the higher-risk areas will provide adequate protection for Lompoc. No further pesticide monitoring or investigation in the Lompoc area is warranted.

Table 1. Highest 16-hour (MITC) or one-day air concentrations, acute screening levels, and acute hazard quotients. The adjusted hazard quotient adds an uncertainty factor for some pesticides to address children's sensitivity. Pesticides with the highest risk are shown in bold. Hazard quotients less than one indicate low risk.

Chemical	Air Concentration (ng/m^3)	Screening Level (ng/m^3)	Hazard Quotient	Adjusted Hazard Quotient
Chloropicrin	nd (37)*	10,000	0.003700	0.003700
Chlorothalonil	trace (4.3)**	560	0.007657	0.007657
Chlorpyrifos	**15.1**	**1,200**	**0.012615**	**0.126150**
Chlorpyrifos OA	2.9	1,200	0.002379	0.023790
Chlorthal-dimethyl	14.2	3,400,000	0.000004	0.000042
Cycloate	12.4	340,000	0.000036	0.000364
Diazinon	**trace (2.1)**	**83**	**0.025942**	**0.025942**
Diazinon OA	**trace (1.6)**	**83**	**0.018862**	**0.018862**
Dicloran	17.6	850,000	0.000021	0.000207
Dicofol	trace (4.0)	68,000	0.000058	0.000175
Dimethoate	trace (1.7)	34,000	0.000049	0.000049
Dimethoate OA	trace (1.4)	34,000	0.000042	0.000042
EPTC	6.5	230,000	0.000028	0.000284
Ethalfluralin	trace (1.8)	1,275,000	0.000001	0.000014
Fonofos	trace (2.0)	34,000	0.000058	0.000582
Fonofos OA	nd (0.26)	34,000	0.000008	0.000078
Iprodione	trace (4.5)	340,000	0.000013	0.000040
Malathion	7.6	40,000	0.000190	0.000190
Malathion OA	2.2	40,000	0.000055	0.000055
Mefenoxam	trace (1.8)	850,000	0.000002	0.000021
Methyl Bromide	trace (3,000)	820,000	0.003658	0.003658
MITC	**1885**	**66,000**	**0.028561**	**0.028561**
Metolachlor	trace (1.7)	312,000	0.000006	0.000056
Naled	trace (2.9)	900	0.003197	0.003197
Oxydemeton methyl + OA	nd (0.5)	87,000	0.000011	0.000011
PCNB	47.7	51,000	0.000935	0.009353
Permethrin	trace (4.3)	64,000	0.000067	0.000672
Propyzamide	trace (5.0)	85,000	0.000059	0.000593
Simazine	nd (0.3)	85,000	0.000004	0.000036
Trifluralin	trace (4.6)	1,700,000	0.000003	0.000027
Vinclozolin	16.2	51,000	0.000318	0.003179
TOTAL (Hazard Index)			0.108539	0.257587

* nd - No detectable amount assumes a concentration one-half the method detection limit concentration, shown in parentheses.

** A trace detection assumes a concentration halfway between the method detection limit and the estimated quantitation limit, shown in parentheses.

Table 2. Highest 3-day (MITC) or 14-day air concentrations, subchronic screening levels, and subchronic hazard quotients. The adjusted hazard quotient adds an uncertainty factor for some pesticides to address children's sensitivity. Pesticides with the highest risk are shown in bold. Hazard quotients less than one indicate low risk.

Chemical	Air Concentration (ng/m^3)	Screening Level (ng/m^3)	Hazard Quotient	Adjusted Hazard Quotient
Chloropicrin	insufficient data to estimate			
Chlorothalonil	trace (3.27)**	8,500	0.000384	0.000384
Chlorpyrifos	**4.05**	**850**	**0.004760**	**0.047603**
Chlorpyrifos OA	**0.95**	**850**	**0.001123**	**0.011227**
Chlorthal-dimethyl	4.43	17,000	0.000261	0.002607
Cycloate	**1.22**	**340**	**0.003594**	**0.035937**
Diazinon	**trace (0.87)**	**83**	**0.010500**	**0.010500**
Diazinon OA	**trace (0.35)**	**83**	**0.004266**	**0.004266**
Dicloran	7.72	42,500	0.000182	0.001816
Dicofol	trace (1.37)	4,930	0.000278	0.000834
Dimethoate	trace (0.28)	17,000	0.000016	0.000016
Dimethoate OA	trace (0.75)	17,000	0.000044	0.000044
EPTC	0.66	240,000	0.000003	0.000027
Ethalfluralin	trace (0.72)	68,000	0.000011	0.000107
Fonofos	trace (0.45)	3,400	0.000132	0.001324
Fonofos OA	nd (0.26)*	3,400	0.000078	0.000778
Iprodione	0.75	102,000	0.000007	0.000022
Malathion	2.47	29,000	0.000085	0.000085
Malathion OA	0.85	29,000	0.000029	0.000029
Mefenoxam	trace (0.40)	136,000	0.000003	0.000030
Methyl Bromide	insufficient data to estimate			
MITC	**616**	**3,000**	**0.205000**	**0.205000**
Metolachlor	trace (1.01)	170,000	0.000006	0.000060
Naled	trace (2.19)	648	0.003383	0.003383
Oxydemeton methyl + OA	nd (0.5)	87,000	0.000011	0.000011
PCNB	**17.87**	**5,100**	**0.003504**	**0.035036**
Permethrin	trace (1.23)	20,230	0.000061	0.000607
Propyzamide	trace (2.34)	85,000	0.000028	0.000275
Simazine	nd (0.3)	8,500	0.000036	0.000358
Trifluralin	trace (4.03)	40,800	0.000099	0.000987
Vinclozolin	3.05	51,000	0.000060	0.000597
TOTAL (Hazard Index)			0.237944	0.363950

* nd - No detectable amount assumes a concentration one-half the method detection limit concentration, shown in parentheses.

** A trace detection assumes a concentration halfway between the method detection limit and the estimated quantitation limit, shown in parentheses.

Table 3. Highest 18-day (MITC) or 10-week air concentrations, chronic screening levels, and chronic hazard quotients. The adjusted hazard quotient adds an uncertainty factor for some pesticides to address children's sensitivity. Pesticides with the highest risk are shown in bold. Hazard quotients less than one indicate low risk.

Chemical	Air Concentration (ng/m^3)	Screening Level (ng/m^3)	Hazard Quotient	Adjusted Hazard Quotient
Chloropicrin	insufficient data to estimate			
Chlorothalonil	trace (1.61)**	8,500	0.000189	0.000189
Chlorpyrifos	**1.91**	**510**	**0.003738**	**0.037383**
Chlorpyrifos OA	**0.51**	**510**	**0.001002**	**0.010025**
Chlorthal-dimethyl	2.12	17,000	0.000125	0.001245
Cycloate	**1.01**	**340**	**0.002979**	**0.029790**
Diazinon	**trace (0.54)**	**83**	**0.006485**	**0.006485**
Diazinon OA	**trace (0.29)**	**83**	**0.003537**	**0.003537**
Dicloran	3.12	42,500	0.000073	0.000733
Dicofol	trace (0.91)	2,040	0.000447	0.001340
Dimethoate	trace (0.28)	850	0.000325	0.000325
Dimethoate OA	trace (0.42)	850	0.000489	0.000489
EPTC	0.43	8,500	0.000050	0.000502
Ethalfluralin	trace (0.45)	68,000	0.000007	0.000066
Fonofos	trace (0.37)	3,400	0.000109	0.001088
Fonofos OA	nd (0.26)*	3,400	0.000078	0.000778
Iprodione	trace (0.75)	102,000	0.000007	0.000022
Malathion	1.23	29,000	0.000043	0.000043
Malathion OA	0.43	29,000	0.000015	0.000015
Mefenoxam	trace (0.33)	136,000	0.000002	0.000024
Methyl Bromide	insufficient data to estimate			
MITC	**244**	**300**	**0.813333**	**0.813333**
Metolachlor	trace (0.54)	170,000	0.000003	0.000032
Naled	trace (1.08)	648	0.001665	0.001665
Oxydemeton methyl + OA	nd (0.5)	87,000	0.000011	0.000011
PCNB	**8.47**	**5,100**	**0.001661**	**0.016609**
Permethrin	trace (0.90)	20,230	0.000044	0.000443
Propyzamide	trace (1.37)	85,000	0.000016	0.000161
Simazine	nd (0.3)	8,500	0.000036	0.000358
Trifluralin	trace (1.90)	40,800	0.000047	0.000467
Vinclozolin	1.91	20,400	0.000094	0.000936
TOTAL (Hazard Index)			0.836610	0.928094

* nd - No detectable amount assumes a concentration one-half the method detection limit concentration, shown in parentheses.

** A trace detection assumes a concentration halfway between the method detection limit and the estimated quantitation limit, shown in parentheses.

Table 4. Hazard indices for each monitoring site. These results should only be used for relative comparisons between sites. These hazard indices do not include the uncertainty factor to address children's sensitivity or the hazard quotients for fumigants.

Monitoring Site	Hazard Index		
	Acute (1 Day)	Subchronic (14 Days)	Chronic (10 Weeks)
Central (APCD Station)	0.064	0.022	0.018
Northwest (Animal Shelter)	0.063	0.038	0.023
Southwest (Miguelito School)	0.025	0.020	0.018
West (Ruth School)	0.071	0.033	0.023

Table 5. Highest 24-hour concentrations measured in Lompoc and previous monitoring studies. Estimated quantitation limits are shown in parentheses for trace detections. Method detection limits are shown in parentheses for pesticides with none detected.

Chemical	Year	County	Maximum 24-hour Concentration (ng/m^3)	Lompoc Maximum 24-hour Concentration (ng/m^3)
Chlorothalonil	1990	Ventura	4.6	trace (7)
Chlorpyrifos	1996	Tulare	815	83*
Chlorpyrifos OA	1996	Tulare	230	8.5*
Diazinon	1997	Fresno	290	18*
EPTC	1996	Imperial	240	6.5
Malathion	1998	Imperial	90	7.6
Malathion OA	1998	Imperial	28	2.2
Methyl Bromide	2000	Monterey/Kern	119,000	trace (4000)
	2001	Monterey/Kern	142,000	trace (4000)
MITC	1993	Kern	18,000	677
	1997	Kern	3,110	677
	1998	Kern	4,530	677
Naled/dichlorvos	1991	Tulare	65	trace (5)
Oxydemeton-methyl	1995	Monterey	none detected (12)	none detected (0.9)
Permethrin	1997	Monterey	trace (15)	trace (7)
Simazine	1998	Fresno	18	none detected (0.6)

* Maximum Lompoc concentration for chlorpyrifos and diazinon are based on Phase One monitoring.

Figure 1. Lompoc study area and location of sampling sites and weather station.

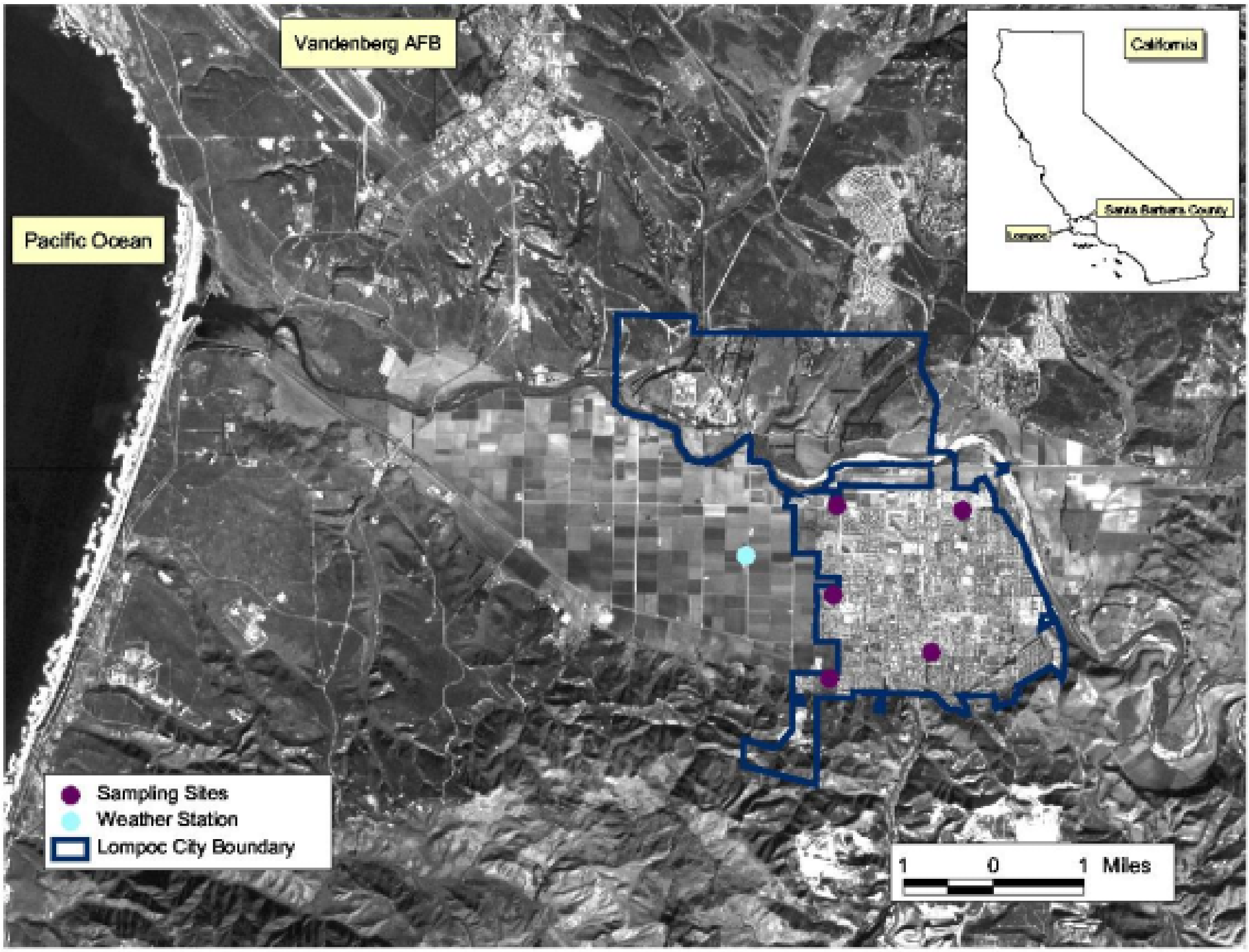

Figure 2. Cumulative (combined) health risk of all monitored pesticides, expressed as the hazard index. A hazard index less than one indicates low risk.

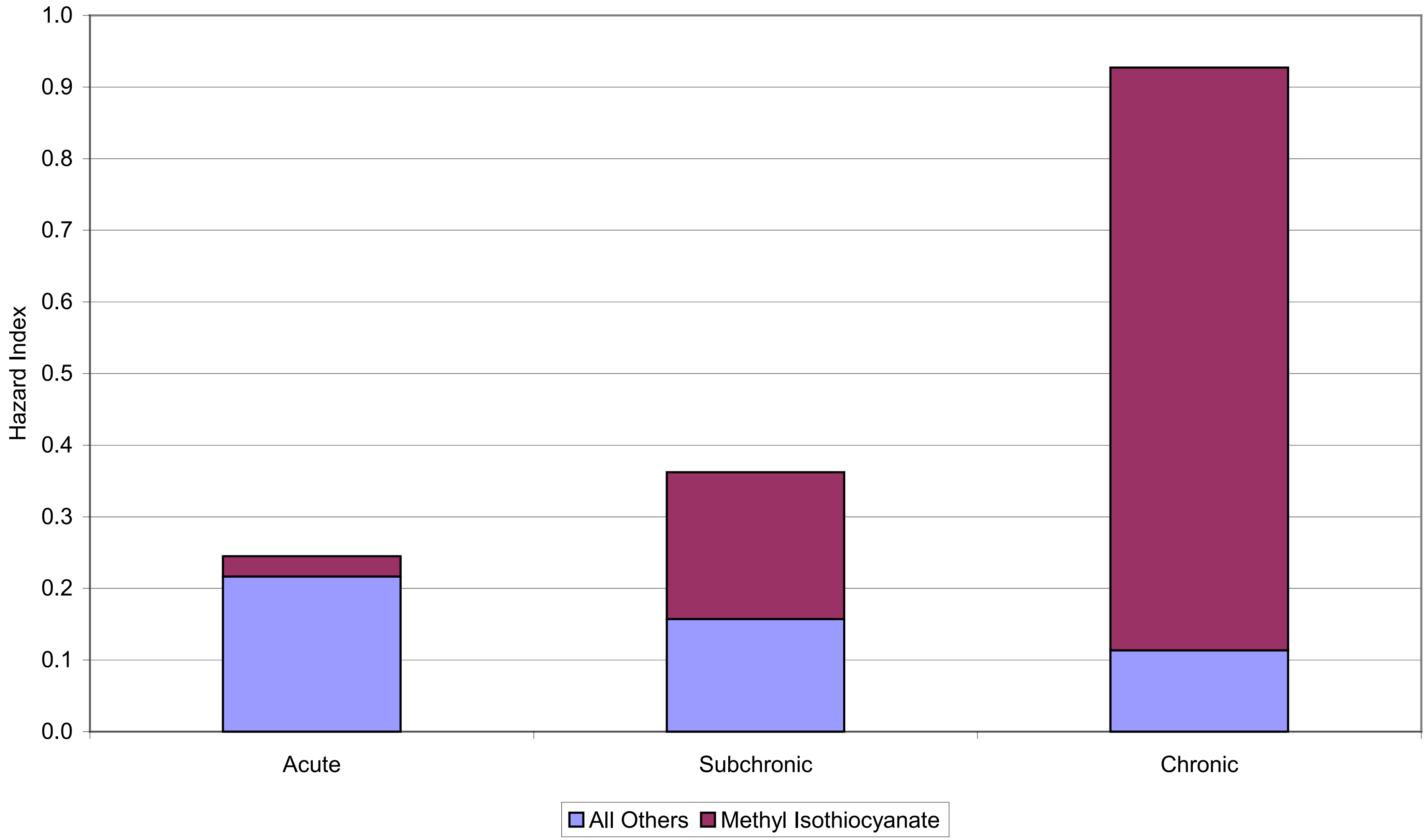

Figure 3. Relative health risk of all monitored pesticides.

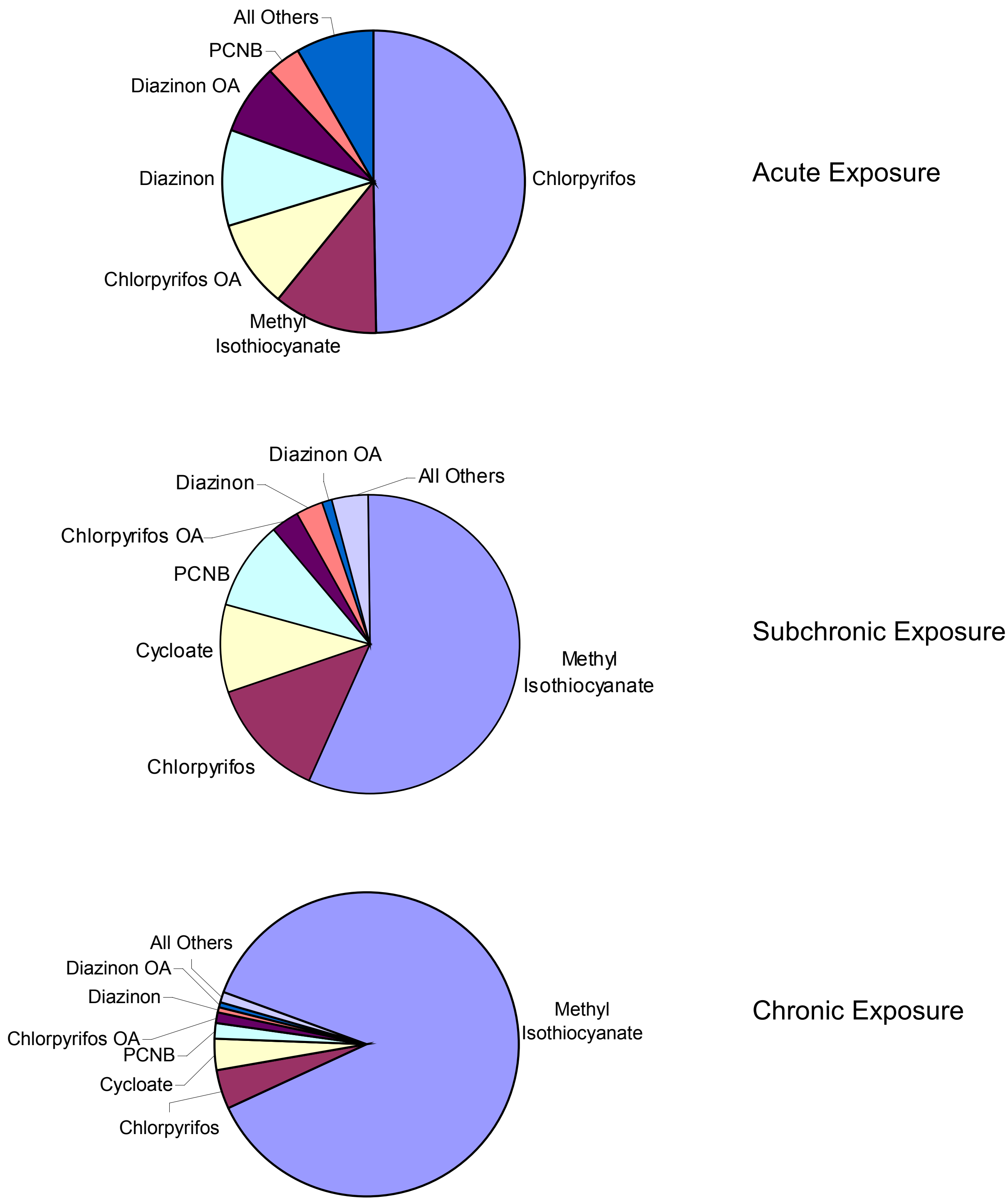

Figure 4. Locations and amount of monitored pesticides applied during the monitoring period (fumigants not included). The wind rose indicates the direction the wind is blow toward, the percentage of time in each direction, and the wind speed.

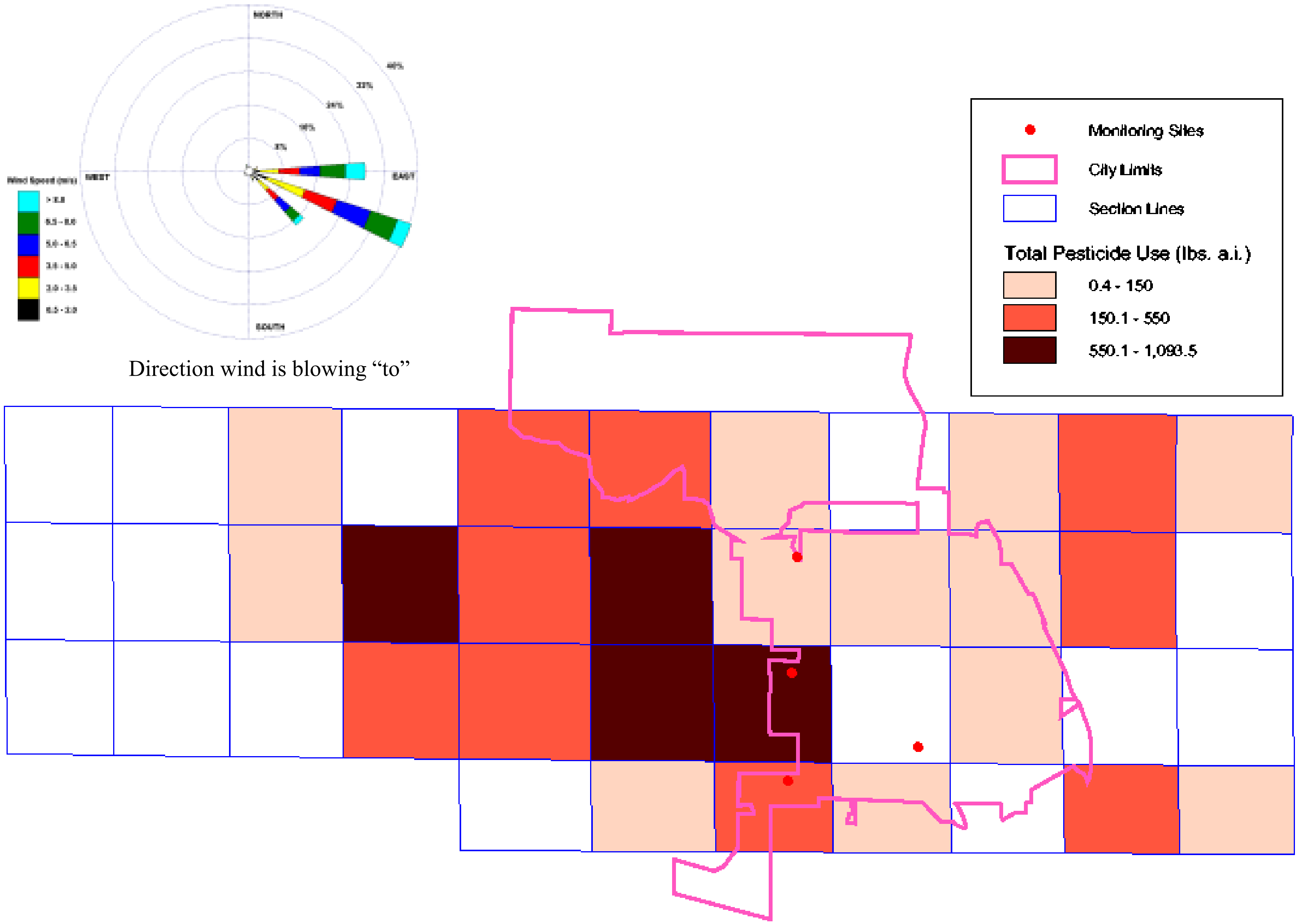

Figure 5. Yearly use of all pesticides reported in the Lompoc area.

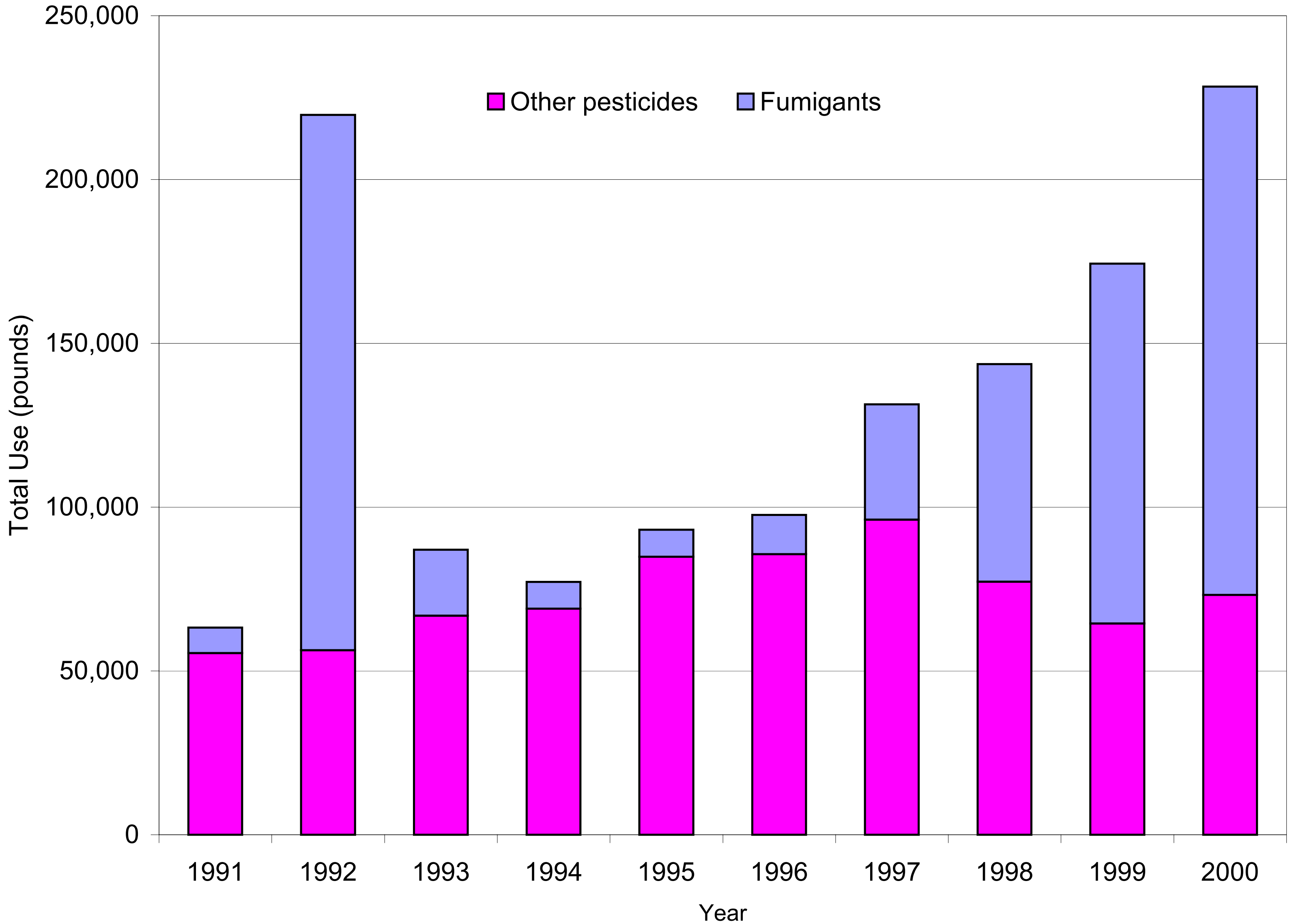

Figure 6. Monthly use (pounds of active ingredient) of all pesticides reported in the Lompoc area during 2000.